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~~RETRACTABLE STEP~~

**BACKGROUND AND SUMMARY**

- [0001]**      The ~~invention present disclosure~~ relates to what is referred to as a retractable step. A retractable step is understood as meaning an entry aid for assisting the entering and exiting of vehicles, particularly rail vehicles, ~~with~~. The retractable step has a surface which can be walked upon being extended from the vehicle essentially in a linear direction in order to bridge the gap between the vehicle and the platform or the like.
- [0002]**      Depending ~~in each case on~~ the positioning between the vehicle box body and the platform, the retractable step, generally toward the end of its extension movement, comes into the region of the platform ~~and there~~. There is the risk in this case of it moving laterally into the essentially vertically extending platform wall. This problem is overcome by means of sensors in the region of the leading edge of the retractable step.
- [0003]**      Another problem is that, in the case of an extended retractable step, a change in height of the retractable step may occur during the time the vehicle spends in the station. This may take place within a short period by the suspension yielding, by the vehicle load changing as passengers get in and out, by the wind load stressing changing, and by more of the same sort of reasons. The greatest possible change in height is defined here by various parameters of the vehicle (type of suspension, position of the stops, length of the lever arms of the retractable step relative to the pivot axis, etc.) and is called maximum change in height below. The actual change in the height position within the context of this maximum change in height may result in luggage or passengers becoming trapped, or the retractable step being damaged if the retractable step is correspondingly lowered. Since the objects at risk generally do not extend over the entire width of the retractable step and it cannot be predicted in which region of the retractable step they are located, detection has hitherto been impossible and the risk of body parts or objects becoming trapped or of the retractable step becoming damaged has had to be accepted.

**[0004]**      The invention aims to change this and to specify present disclosure relates to a device with which it is possible to carry out a detection of ~~this~~ the above-mentioned type in a satisfactory and cost-effective manner.

**[0005]**      According to the ~~invention~~ present disclosure, this is achieved in that a strip is connected movably to the retractable step, ~~said~~. The strip extending extends essentially over the entire length of the retractable step and, in the activated state, being located essentially under the front edge of the retractable step, ~~and by~~. In addition, at least one sensor ~~being~~ is provided which detects the position of the strip and/or the force transmitted by the strip to the retractable step.

**[0006]**      As a result, every impermissible approach toward the upper side of the platform can be detected as can the imminent risk of an object or body part becoming trapped. The positioning of the strip makes it possible, during the extension of the retractable step, also to detect the space (detection space) in which, during ~~the a~~ a lowering operation, the retractable step could move, ~~for example for one of the above-mentioned reasons~~, and thus makes it possible to safeguard it. ~~The~~ An activated state is taken up by the strip at least during the extension of the retractable step.

**[0007]**      The movable connection between strip and retractable step makes it possible to bring the strip into the desired position, if appropriate automatically, during the extension of the retractable step. The monitoring of this position remains activated during the extension of the retractable step into its end position.

**[0008]**      If a change in the position of the strip is detected, the extension movement is stopped and the retractable step is moved back by a predetermined length by which a safe distance from the object is ensured. In addition, for example, an acoustic and/or optical alarm signal may be emitted. Of course, a different reaction is possible if this is desired by the operator.

**[0009]**      The strip itself may either execute an extension movement which is oblique with respect to the direction of extension of the retractable step but is essentially linear; ~~it~~. It may also execute a rotational movement and be swung out, ~~as it were~~.

- [00010] Depending in each case on the design and movement of the strip, a very wide variety of sensors, which can be designed as switches or strain gauges or are based on an electrodynamic or piezoelectric effect, are suitable as the actual sensor. The sensors may be arranged either directly in the strip and measure the force between an underlying surface and the strip, or they are accommodated in the region of the bearings of the strip and measure the forces between the strip and retractable step, which forces may originate from the first-mentioned forces.
- [00011] The transition of the strip from the passive position into the active position can take place by means of the dead weight of the strip, a slotted-guide mechanism and possibly a spring. Of course, it is also possible to provide a motor drive.
- [00012] ~~In order to reach the objective of the invention and in particular~~ accordance with the present disclosure, if the retractable step is to be retracted if a trapping risk is established, it is favorable that, during this retraction movement, the strip releases any objects already trapped as rapidly as possible without further loading and does not trap and keep hold of them.
- [00013] ~~The invention is explained in more detail below with reference to the drawing, in which~~ Other aspects of the present disclosure will become apparent from the following descriptions when considered in conjunction with the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

- [00014] ~~fig. Figure 1 shows a front view of an entry aid designed~~ embodiment of a retractable step, according to the invention, present disclosure.
- [00015] ~~fig. Figure 2 shows a purely diagrammatic section~~ partial sectional view in the direction of the arrow II of fig. 1, Figure 1.
- [00016] ~~fig. Figure 3 shows a variant~~ partial sectional view on an enlarged scale of another embodiment of a retractable step similar to that of fig. 2, on an enlarged scale, according to the present disclosure.

**[00017]** ~~fig. Figure 4 shows a partial sectional view similar to fig. 3 of another variant of the invention, and~~embodiment of a retractable step, according to the present disclosure.

**[00018]** ~~fig. Figure 5 shows the variant of the invention according to fig. 4~~embodiment of Figure 5 in a different position between the vehicle and the platform.

### DETAILED DESCRIPTION

**[00019]** Fig. 1 shows a vehicle 1 with a two-wing door 2 and a retractable step 3. The ~~A~~ "detection space" 4, ~~i.e. that is a space which is to be monitored by the a device, according to the invention present disclosure, for risk of collision or trapping during the extension of the retractable step 3, is illustrated below the retractable step 3 by dashed lines.~~

**[00020]** The positioning and significance of ~~this~~ detection space 4 are apparent ~~from putting figs 1 and 2 together: fig. 2~~by viewing Figures 1 and 2. Figure 2 shows a platform 5 as it is intended normally to extend with its surface and its side wall in relation to the vehicle 1. Between the platform 5 and the vehicle 1 there is unavoidably a gap 6, precisely the. Such a gap which in many cases, if platforms 6 may exist in curved track sections in the case of rail vehicles are considered, and which gap 6 may also be significantly wider than in the exemplary embodiment shown and for the. A safe overcoming or overclimbing of which the such gaps 6 is provided by retractable step 3 is provided.

**[00021]** Fig. 3 shows ~~the situation in the region of the platform 5 on an enlarged scale, but likewise entirely schematically. In the exemplary embodiment shown, the~~Figure 3, a strip 7 is provided according to the invention present disclosure and comprises a rotatable flap, that could also be a bracket or a bracket displaced in a guide, which extends over the an entire length L (fig. 1 see Figure 1) of the retractable step 3 and. Strip 7 is located essentially precisely below the a leading edge 8 of the retractable step 3[[.]] when said flap is extended in its activated position, as illustrated in ~~fig. Figure 3.~~

**[00022]** The dashed line below the retractable step 3 again indicates the detection space 4[[.]]. Detection space 4 i.e. is the space over which the a lower edge 9-13 of the strip 7 brushes during its extension in the direction A of the double arrow E-A. If, during the extension

operation, the ~~strip front edge 9~~ of the strip 7 impacts at any point along the length L against an object, this impact is established or detected by a ~~at least one sensor, which is.~~ The at least one sensor may measure an angle between the strip 7 and the step 3, for example, angle  $\alpha$  as shown in Figure 3. The at least one sensor may be arranged, in the exemplary embodiment, in the a bearing 10 between the strip 7 and the retractable step 3, and the measures. After a detection, measures or actions provided for this purpose by the operator are taken by an operator. After reaching the an end position of the retractable step 3, the strip 7 ~~has to fold folds~~ away and ~~release-releases~~ or no longer defines the detection space 4.

**[00023]** Fig. 4 shows, ~~likewise purely diagrammatically,~~ another embodiment of a retractable step 3 having a strip 7'; in this example, the. The strip 7' is lowered downward about a joint 10' and a. A sliding movement would be possible in a similar manner. The movement of the strip 7 or 7' between the active position ~~illustrated shown~~ and the a position in which it ~~the strip 7'~~ is placed against the retractable step 3 or pushed into recesses (not shown) in the a contour (not shown) of the retractable step 3 is brought about by the dead weight and/or by assistance by means of a spring force (not shown); of course, as mentioned above, an An active movement by means of a servomotor or the like is also possible.

**[00024]** Fig. 5 shows the a situation which arises in the case of a device according to the invention according to fig. 4 if even may arise during the extension of the retractable step 3, the of Figure 4. A height position of the vehicle 1 relative to the platform upper edge 11 is too low, with the result that the strip 7' impacts with its front edge 9' against the vertical front 12 of the platform 5 below the platform upper edge 11. This is also established or detected by the a position sensor in the joint 10' and results in the specified reaction, as mentioned above. The same happens if the strip 7' impacts against a different obstacle (not shown). Instead of the position sensor in the joint 10', a force sensor may be arranged directly on the front edge 9' of the strip 7'.

**[00025]** The ~~invention present disclosure~~ is not restricted or limited to the exemplary embodiments outlined and described and disclosed. It is possible to design the front edges

9, 9' themselves as sensors, whether by these edges 9, 9' carrying profiles which are designed as electric switching strips or which are filled with gas, ~~in which case the~~. In the case of the gas, a rising gas pressure when running onto an object is measured and established, or whether. Or, the strips 7, 7' ~~for their part may~~ comprise two parts which are movable with respect to each other and the movement of these parts with respect to each other is used as a measure of the striking against an obstacle.

**[00026]** It is ~~essential~~ important that a strip 7, 7' is arranged in the region below the leading edge 8 of the retractable step 3 and over the entire length 11 of the retractable step, ~~and 3.~~ It is also important that the load acting on ~~this strip~~ 7, 7' in its entirety and/or the position of the strip 7, 7' is established by ~~means of~~ a sensor, and that, if a specified value is exceeded, the movement of the retractable step 3 is stopped and, if appropriate, an alarm is triggered.

**[00027]** Although the present disclosure has been described and illustrated in detail, it is to be clearly understood that this is done by way of illustration and example only and is not to be taken by way of limitation. The scope of the present disclosure is to be limited only by the terms of the appended claims.

CLAIMS CLAIM:

This listing of claims will replace all prior versions and listings of claims in the application:

**Listing of Claims:**

1. ~~(Currently Amended) A retractable step for the entering and exiting of vehicles (1), particularly rail vehicles, with a surface which can be walked upon, a retractable step (3), being extended from the vehicle essentially in a linear direction in order to bridge the gap (6) between the vehicle (1) and the platform (5) or the like, the retractable step comprising a device with at least one sensor, which is intended to prevent a collision with objects during the extension operation, characterized in that the device is a strip (7, 7') which is connected movably to the retractable step (3), extends essentially over the entire length (L) of the retractable step and, in the activated state, is located essentially under the leading edge (8) of the retractable step (3), and comprises at least one sensor which detects either the position of the strip (7, 7') relative to the retractable step or the force transferred from the strip to the retractable step.~~ A retractable step for entering and exiting rail vehicles, the retractable step having a surface which can be walked upon and being configured to be extended in an essentially linear direction to bridge a gap between the rail vehicle and a platform. the retractable step comprising:

a leading edge;

a strip being movably connected to the retractable step and extending over an entire length L of the retractable step;

the strip having at least one sensor and arranged to prevent a collision with objects during an extension operation of the retractable step; and

wherein, when the retractable step is in an extended position, the strip is at least partially located under the leading edge and the at least one sensor detects one of the following: (1) a position of the strip relative to the retractable step and (2) a force transferred from the strip to the retractable step.

2. (Currently Amended) The retractable step as ~~claimed in claim of Claim 1,~~  
~~characterized in that~~wherein the strip (7) is a rotatable flap.
3. (Currently Amended) The retractable step as ~~claimed in claim of Claim 1,~~  
~~characterized in that~~wherein the strip (7') is a rotatable bracket.
4. (Currently Amended) The retractable step as ~~claimed in claim of Claim 1,~~  
~~characterized in that the strip is a bracket which can be displaced~~displaceable in a guide.
5. (Currently Amended) The retractable step as ~~claimed in claim 2 or 3 of Claim 1,~~  
~~characterized in that~~wherein the at least one sensor measures an angle between the strip (7,  
7') and the retractable step.
6. (Currently Amended) The retractable step as ~~claimed in one of claims 1 to 4 of~~  
Claim 1, ~~characterized in that~~wherein the at least one sensor is fitted to ~~the a~~ front edge (9, 9')  
of the strip.



**IN THE DRAWING:**

Please note the enclosed Figures 3, 4 and 5 marked as “Annotated Sheets”.

Please enter the enclosed Figures 3, 4 and 5 marked as “Replacement Sheets”.

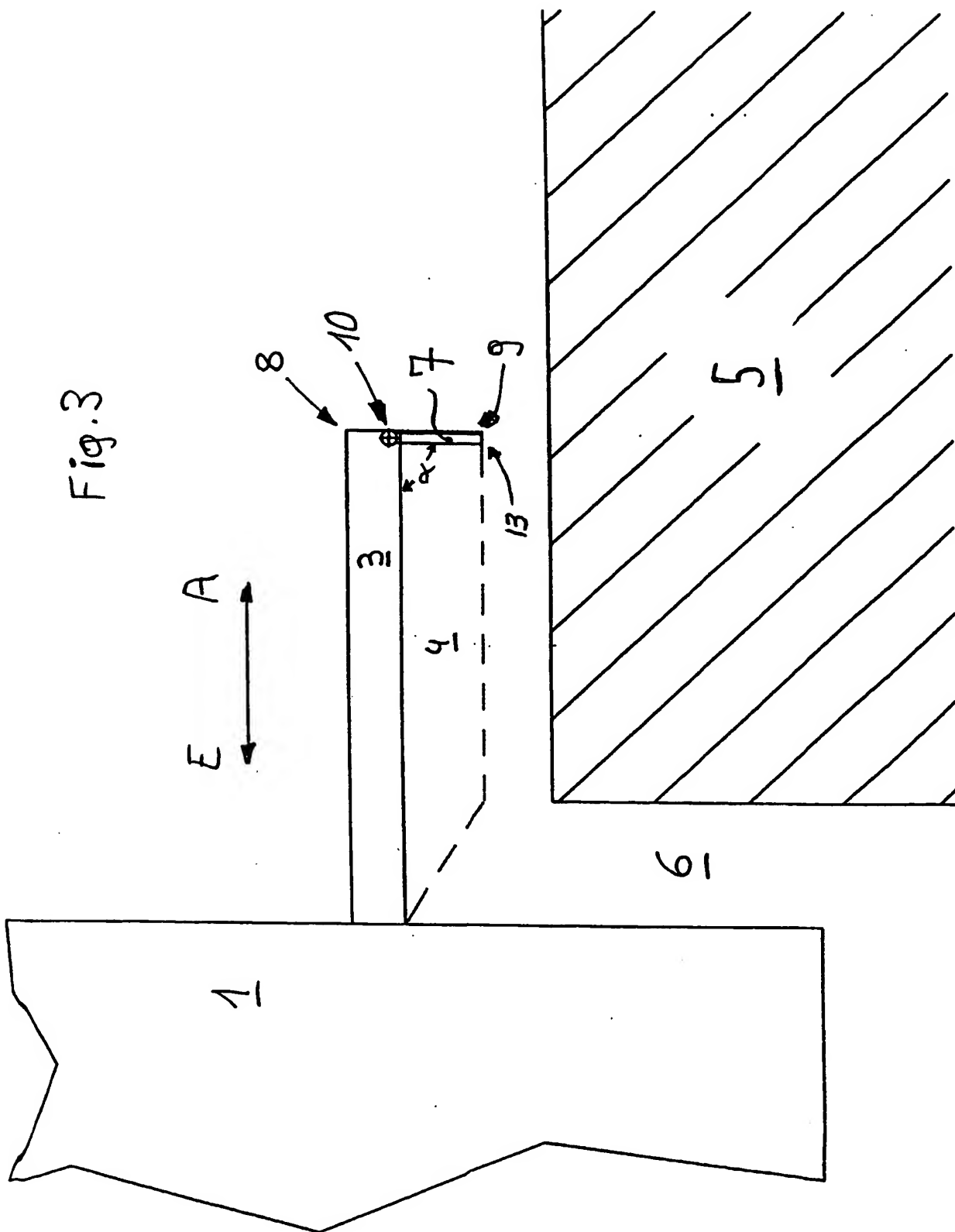


Fig. 4

